

WHAT IS CLAIMED IS:

1. A gas sensor comprising:
a resonator comprising a dielectric material, the resonator further including a layer comprising adsorptive nanostructures selected from the group consisting of degassed carbon nanotubes, activated carbon fibers, and adsorptive nanowires, wherein the dielectric material is in electrical communication with the layer comprising the adsorptive nanostructures such that the effective resonant frequency of the resonator depends upon the dielectric constant of the dielectric material and also depends upon the dielectric constant of the layer comprising the adsorptive nanostructures.
2. The gas sensor of claim 1 further comprising an analyzer in communication with the resonator for obtaining the resonant frequency of the resonator.
3. The gas sensor of claim 2, wherein the analyzer is in hard-wire communication with the resonator.
4. The gas sensor of claim 2, wherein the analyzer is in remote access communication with the resonator.
5. The gas sensor of claim 4, wherein the analyzer is in communication with the resonator via radio frequency signals.
6. The gas sensor of claim 1, wherein the resonator is a micro-strip circuit board resonator.
7. The gas sensor of claim 1, wherein the adsorptive nanostructures are degassed carbon nanotubes
8. The gas sensor of claim 7, wherein the degassed carbon nanotubes comprise single-walled carbon nanotubes.
9. The gas sensor of claim 7, wherein the degassed carbon nanotubes comprise multi-walled carbon nanotubes.
10. The gas sensor of claim 1, wherein the layer comprising adsorptive nanostructures is about $2\mu\text{m}$ in depth.
11. A solid-state gas sensor comprising:
a micro-strip circuit board resonator comprising:
a ground plane,
a dielectric substrate applied to the ground plane,

a conducting micro-strip applied to the dielectric substrate,
 a layer comprising degassed carbon nanotubes applied to a
surface of the conducting micro-strip, wherein the layer comprising degassed
carbon nanotubes is in electrical communication with the dielectric substrate; and
 an analyzer in communication with the resonator for obtaining the
resonant frequency of the resonator.

12. The gas sensor of claim 11, wherein the resonator is a circular disk resonator.

13. The gas sensor of claim 11, wherein the analyzer is in hard-wire communication with the resonator.

14. The gas sensor of claim 11, wherein the analyzer is in remote access communication with the resonator.

15. The gas sensor of claim 14, wherein the analyzer is in communication with the resonator via a radio frequency signal.

16. The gas sensor of claim 11, wherein the layer comprising degassed carbon nanotubes comprises single-walled carbon nanotubes.

17. The gas sensor of claim 16, wherein the single-walled carbon nanotubes are between about 1 and about 10 nanometers in diameter.

18. The gas sensor of claim 11, wherein the layer comprising degassed carbon nanotubes comprises multi-walled carbon nanotubes.

19. The gas sensor of claim 18, wherein the multi-walled carbon nanotubes are between about 10 and about 100 nanometers in diameter.

20. A method for detecting the presence of organic material in a vapor stream comprising:

 providing a resonator comprising a dielectric material in electrical communication with an amount of adsorptive nanostructures;

 obtaining the initial resonant frequency of the resonator;

 contacting the resonator with a vapor stream comprising an organic material;

 adsorbing a portion of the organic material from the vapor stream onto the adsorptive nanostructures, wherein the resonant frequency of the resonator is altered upon adsorption of the organic material onto the nanostructures; and

obtaining the altered resonant frequency of the resonator.

21. The method of claim 20, wherein the method is carried out at room temperature.

22. The method of claim 20, wherein the altered resonant frequency of the resonator is obtained within about 10 minutes of contacting the resonator with the vapor stream.

23. The method of claim 20, wherein the organic material is at a concentration in the vapor stream of between about 100 ppb and about 1500 ppm.

24. The method of claim 20, further comprising recovering the initial resonant frequency of the resonator by preventing contact between the vapor stream and the resonator following the step of obtaining the altered resonant frequency.

25. The method of claim 24, wherein the initial resonant frequency is recovered within about 10 minutes of the prevention of contact between the vapor stream and the resonator.

26. The method of claim 20, further comprising identifying the organic material based upon the difference between the initial resonant frequency and the altered resonant frequency.

27. The method of claim 20, further comprising identifying the concentration of the organic material based upon the difference between the initial resonant frequency and the altered resonant frequency.

28. The method of claim 20, wherein the adsorptive nanostructures are carbon nanotubes.

29. A method for detecting the presence of material in a gaseous stream comprising:

providing a resonator comprising a dielectric material in electrical communication with an amount of adsorptive nanostructures;

degassing the nanostructures;

holding the resonator comprising the degassed nanostructures in a vacuum;

obtaining the initial resonant frequency of the resonator;

contacting the resonator with a gaseous stream comprising a material, wherein the material is selected from the group consisting of polar gases, non-polar gases, organic vapors, and mixtures thereof;

adsorbing a portion of the material onto the degassed nanostructures, wherein the resonant frequency of the resonator is altered upon adsorption of the material onto the degassed nanostructures; and

obtaining the altered resonant frequency of the resonator.

30. The method of claim 29, wherein the method is carried out at room temperature.

31. The method of claim 29, wherein the altered resonant frequency of the resonator is obtained within about 10 minutes of contacting the resonator with the gaseous stream.

32. The method of claim 29, wherein the material is at a concentration in the gaseous stream of between about 100 ppb and about 1500 ppm.

33. The method of claim 29, further comprising recovering the initial resonant frequency of the resonator.

34. The method of claim 29, further comprising identifying the material in the gaseous stream based upon the difference between the initial resonant frequency and the altered resonant frequency.

35. The method of claim 29, further comprising identifying the concentration of the material based upon the difference between the initial resonant frequency and the altered resonant frequency.

36. The method of claim 29, wherein the adsorptive nanostructures are carbon nanotubes.

37. A method for forming a gas sensor comprising:

providing a resonator comprising a dielectric material; and

applying a layer comprising adsorptive nanostructures to a surface of the resonator, wherein the layer comprising adsorptive nanostructures are in electrical communication with the dielectric material, wherein the adsorptive nanostructures are selected from the group consisting of degassed carbon nanotubes, activated carbon fibers, and adsorptive nanowires.

38. The method of claim 37, wherein the resonator is a micro-strip circuit board resonator.

39. The process of claim 37, the process further comprising etching a conductive micro-strip on the surface of the dielectric material, wherein the layer comprising adsorptive nanostructures is applied to a surface of the conductive micro-strip.

40. The method of claim 37, wherein adsorptive nanostructures are degassed carbon nanotubes, the step of applying the layer comprising adsorptive nanostructures comprising:

applying a layer comprising carbon nanotubes to a surface of the resonator; and

degassing the layer comprising carbon nanotubes.

41. The method of claim 40, wherein the carbon nanotubes are multi-walled carbon nanotubes.

42. The method of claim 40, wherein the carbon nanotubes are single-walled carbon nanotubes.

43. The method of claim 40, wherein the layer comprising carbon nanotubes is degassed by the process of:

holding the resonator at a pressure between about 1×10^{-5} and 2×10^{-4} torr for a period of at least about 12 hours; and

simultaneously holding the resonator at a temperature of between about 100°C and about 125°C.